A Report Prepared for

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FINAL REMOVAL ACTION REPORT
GAS EXTRACTION REMOVAL ACTION
48TH AND HOLLY LANDFILL
OPERABLE UNIT 6
SAND CREEK SUPERFUND SITE
COMMERCE CITY, COLORADO

HLA Job No. 06234,092.10

by

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October 31, 1991

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1.0 INTRODUCTION

This Removal Action Report for the landfill gas (LFG) extraction system at Operable Unit (OU) 6 of the 48th and Holly Landfill (the Landfill) in Commerce City, Colorado, was prepared by Harding Lawson Associates (HLA) on behalf of Landfill, Inc. (LI), and Burlington Northern Railroad (BNR) in accordance with the U.S. Environmental Protection Agency (EPA) Administrative Order for OU 6, effective August 25, 1990 (EPA, 1990). The prime contract for the construction of the LFG extraction system was awarded to Organic Waste Technologies (OWT) Construction Company, Middleburg Heights, Ohio.

1.1 PURPOSE AND SCOPE

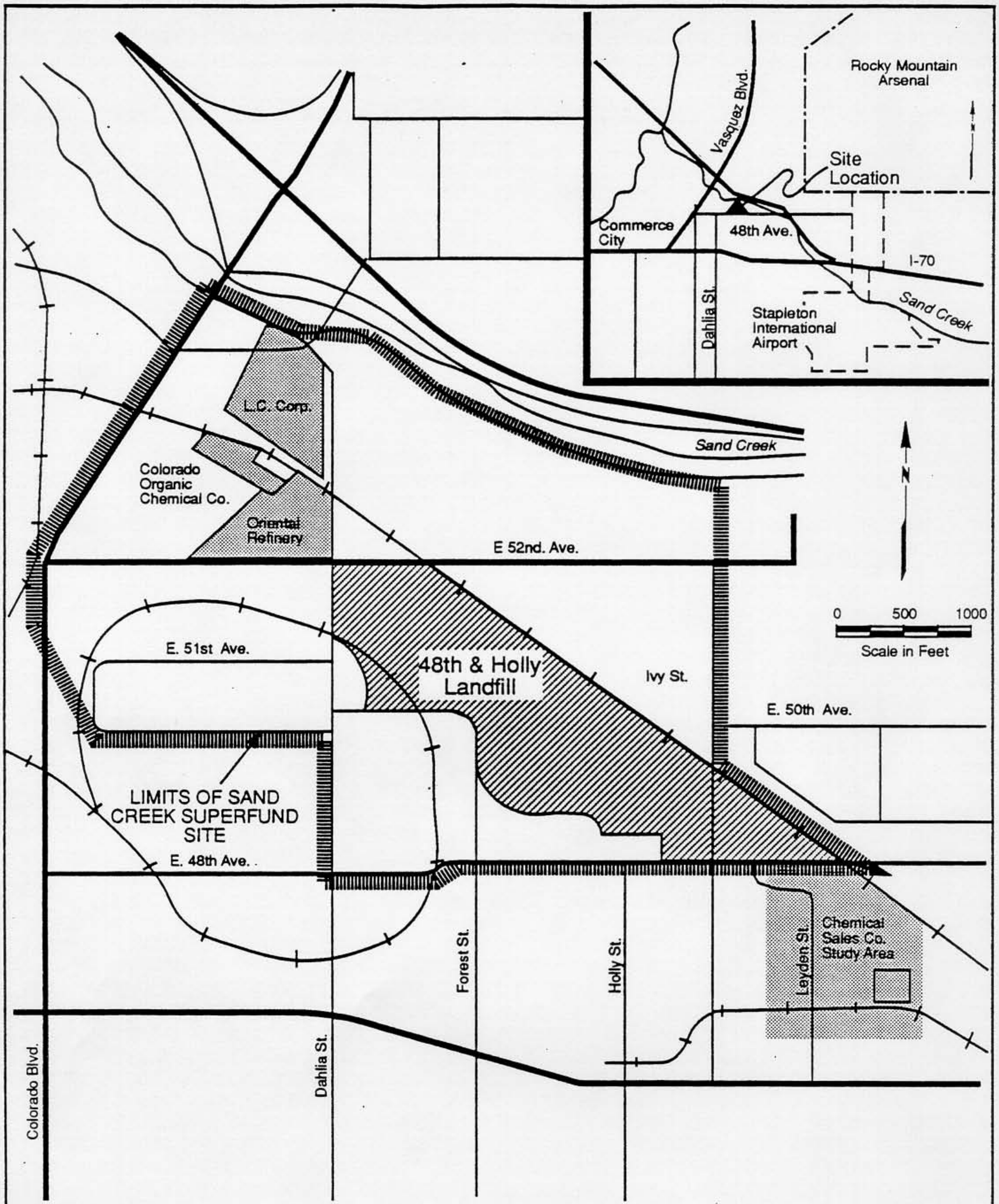
The purpose of this Removal Action Report is to provide EPA and the State of Colorado Department of Health (CDH) a basis for evaluating the removal action and accepting the project as complete in accordance with the requirements of the Action Memorandum and the OU6 Statement of Work.

This Removal Action Report provides a description of the site (Section 1.2) and the components of the LFG extraction system (Section 2.1). Design criteria for the system are discussed in Section 2.2. Construction milestones are identified in Section 2.3. Section 3.0 presents modifications to the design that were implemented during construction and includes a discussion of potential impacts on the system as a result of the field modifications. Initial performance monitoring of the LFG extraction system is discussed in Section 4.0. Record drawings of the system that were prepared during construction are included as Appendix A. Certification by a registered professional engineer that the LFG extraction system is operating as designed is provided in Appendix B. Equipment and material submittals that were reviewed and accepted during construction were previously transmitted to EPA under separate cover. Photographs that were taken during construction to document preconstruction conditions and installation of buried piping and facilities were also previously transmitted to EPA and the CDH under separate cover.

1.2 SITE DESCRIPTION

The Sand Creek Industrial Site (the Site) is located in Commerce City, Colorado, northeast of downtown Denver. The Site was used as an industrial production and waste disposal area for several decades. During that time, the Landfill, Oriental Refinery, Colorado Organic Chemical Company, and the L.C. Corporation occupied the Site.

Figure 1.1 presents a site map of the Landfill, which is located in the southern portion of the Site and is bordered on the north by East 52nd Avenue, on the northeast by the Chicago Rock Island and Pacific Railroad, on the south by East 48th Avenue, and on the west by Dahlia Street. The Landfill straddles the Denver/Adams County boundary. The surface area of the Landfill is approximately 150 acres.



Harding Lawson Associates
Engineering and Environmental Services

Site Map
48th & Holly Landfill
Operable Unit 6
Commerce City, Colorado

FIGURE **1.1**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
RLB	06234,092.10	Drnw	10/91	

2.0 SYSTEM DESCRIPTION AND CONSTRUCTION MILESTONES

This section describes the major components of the LFG extraction system at the Landfill and the design criteria used to select the major components. Additional detail regarding system design rationale is provided in Part A of the Final Design Submittal for the removal action (BFI Gas Systems, Inc., and HLA, 1991). Major milestones during construction of the LFG extraction system are also summarized in this section.

2.1 SYSTEM DESCRIPTION

The LFG extraction system, which was designed by BFI Gas Systems, Inc., primarily comprises the following:

- LFG extraction wells
- Gas collection piping, consisting of a main header and 13 subheaders
- Condensate sumps, piping, and knockout pot
- Condensate storage tank
- Gas extraction blowers and ancillary equipment
- Enclosed gas flare system
- Blower building
- Gas monitoring probes

2.1.1 Landfill Gas Extraction Wells

The function of the LFG extraction wells is to capture as much of the LFG within the Landfill as possible and minimize its vertical and lateral migration. The location and number of wells depends on several variables, including pre-Landfill and final Landfill topography, location of slope benches and/or drainage swales, limits of waste fill, cell construction, and the radius of influence exerted by each extraction well.

A total of 75 LFG extraction wells were installed within the Landfill, as shown in Appendix A on record drawing 1. Wells were typically spaced on 200-foot centers and were installed by drilling 36-inch-diameter boreholes through the depth of refuse. The base of the refuse was determined visually by the absence of trash in the drill cuttings.

Record drawing 9 (Appendix A) shows typical well completion details. The completion detail used for construction of a particular well was a function of the thickness of soil cover at the LFG extraction well location. LFG extraction wells consist of solid and perforated 6-inch-diameter high-density polyethylene (HDPE) pipe. The length of perforated pipe is a function of the depth of refuse. The length of solid pipe is 12 feet for wells 30 feet deep or less and 15 feet for wells more than 30 feet deep. All extraction wells are protected by fiberglass well encasements with removable locking lids.

2.1.2 Gas Collection Piping

A total of 15,685 feet of buried HDPE pipe was installed at the Landfill to transport LFG from the extraction wells to the enclosed gas flare system. Each extraction well is connected to one of 13 parallel subheaders that were constructed in a north-south direction across the Landfill, or to the main header. The main header is located along the northern boundary of the Landfill and intersects all of the subheaders. An isolation valve is provided at each subheader connection to the main header.

The gas collection piping layout for the Landfill is shown on record drawing 1 (Appendix A). Piping profiles are shown on record drawings 3 through 8 (Appendix A).

2.1.3 Condensate Sumps, Piping, and Knockout Pot

LFG is typically saturated with water vapor; when the LFG is extracted and subjected to cooling and reduced pressure, moisture condenses from the LFG. At the Landfill, this condensing occurs in the LFG collection piping and in the knockout pot located in the blower building.

Condensate that forms in the underground pipeline flows by gravity, and to some extent by movement of LFG through the pipeline, to one of four condensate sumps, each located at a low point along the main header. Condensate sump locations are shown on record drawing 1 (Appendix A).

Condensate collected in HDPE tanks located in each condensate sump will be automatically pumped from the respective sump, when the liquid level in the HDPE tank reaches a predetermined height, via the liquid-level controls and a centrifugal pump installed in the respective condensate sump. Condensate is pumped from the condensate sumps directly to the condensate storage tank. A total of 2841 feet of 3-inch HDPE condensate piping was installed for the purpose of transferring condensate from the HDPE tanks located in the condensate sumps to the condensate storage tank.

A knockout pot constructed of HPDE was installed in the blower building to capture condensate in the gas stream that did not condense in the underground piping. Before entering the blowers, gas is diverted through the knockout pot. The knockout pot is equipped with a sight glass to monitor fluid level and a manual drain system to transfer any accumulated condensate to the condensate storage tank.

The condensate sumps, piping, and knockout pot are shown on record drawings 11 and 14 (Appendix A).

2.1.4 Condensate Storage Tank

A buried condensate storage tank was installed for the purpose of collecting condensate from the condensate sumps and the knockout pot. The tank is double-walled and constructed of fiberglass-reinforced plastic with a holding capacity of 10,000 gallons. The annular space between the primary and secondary tanks is filled with a colored brine solution for leak detection during and after installation. The colored solution aids in visually detecting leaks that may have occurred during transport or placement of the tank. A monitoring system was installed with the tank to continuously monitor the level of brine solution in the annular space and provide an audible and visual alarm to announce leaks from the primary tank. Details of the condensate storage tank are included on record drawings 15 and 16 (Appendix A).

The condensate storage tank is equipped with a submersible pump that transfers condensate to the City and County of Denver sanitary sewer located along 50th Avenue. The instantaneous flow rate and the total volume of condensate transferred from the condensate storage tank to the sewer is recorded by a totalizing flow meter. The flow meter is installed in a corrugated metal pipe (CMP) meter pit located approximately 90 feet north of the tie-in of the condensate transfer line to the City and County of Denver sanitary sewer. In addition, a sample tap was installed in the condensate transfer line in a CMP manhole to sample condensate transferred to the sanitary sewer. The locations of the flow meter and sample tap are shown on record drawing 16 (Appendix A).

2.1.5 Gas Extraction Blowers and Ancillary Equipment

The function of the LFG extraction blowers is to induce a vacuum on the LFG collection piping and extraction wells to draw LFG from the Landfill and force it into the enclosed flare system for subsequent combustion.

The LFG extraction system is equipped with two parallel centrifugal blowers, which will allow alternate operation and provide a backup if one blower fails or is out of service for maintenance. The blowers are located downstream of the knockout pot and mounted in an enclosed building in the northwestern portion of the site, as shown on record drawings 1 and 11 (Appendix A). The outlet of the blowers is piped to the enclosed flare.

2.1.6 Enclosed Gas Flare System

A flare system is generally required as part of an LFG extraction system to destroy odors and toxic components in the LFG. The flare system installed at the Landfill is enclosed, with the combustion flame contained within an insulated stack. The enclosed flare system serves the dual purpose of secluding the flame from view and increasing the combustion efficiency of the flare. The flare is installed south of the blower building, as shown on record drawings 1, 30-101, and 30-102 (Appendix A).

The enclosed flare system consists of a 50-foot-high by 8-foot-diameter stack with three burners, a flare pilot assembly, purge blower, flame sensor, and control panel. A propane tank supplies the flare pilot assembly with fuel to ignite a pilot flame. Gas entering the flare is diverted through the burners and ignited by the flare pilot assembly.

2.1.7 Blower Building

A 22-foot-wide by 26-foot-long pre-engineered metal building was installed at the Landfill to house the knockout pot and the centrifugal blowers. The building is equipped with an explosion proof exhaust fan to provide ventilation and an explosion proof heater to prevent freezing of condensate in the knockout pot.

The building contains a combustible gas sensor interlocked with the exhaust fan. An associated control panel is mounted adjacent to the enclosed flare system control panel immediately west and outside of the blower building. If the level of combustible gases in the blower building exceeds 10 percent of the lower explosion limit (LEL), the exhaust fan engages and a visual alarm is activated at the gas sensor control panel. At 15 percent LEL, a visual and audible alarm is activated at the control panel and a red warning light on the outside of the blower building above the access doors is activated.

2.1.8 Gas Monitoring Probes

A total of 13 gas monitoring probes were installed around the perimeter of the Landfill to monitor LFG collection system performance. Record drawing 1 (Appendix A) shows the locations of the gas monitoring probes. As of the date of this report, property access restrictions have prohibited the installation of the remaining nine gas monitoring probes that were included in the final design of the LFG extraction system.

2.2 COMPONENT DESIGN CRITERIA

This section provides the rationale, criteria, and calculations to support the design of LFG extraction system components.

2.2.1 Landfill Gas Extraction Wells

To achieve optimal results, LFG extraction wells should be spaced such that all (or most) of the LFG within the sphere or radius of influence of each well is extracted without drawing atmospheric air into the system through the soil cover. The following equation was used to calculate the radius of influence for each extraction well at the Landfill to meet the required criteria. This equation is from Methane Generation and Recovery from Landfills (EMCON and Associates, 1982) and is widely accepted in the industry and by numerous regulatory agencies.

$$Qw = K*3.14*(R*R)*t*D*r/C$$

where:

Qw = extraction well flow rate
= perforated length of wellpipe *1.0 cfm/lf

K = a compilation of conversion factors
= $7.047 * 10^{-8}$ (cy/yr)/(cf/min)

R = radius of influence (ft)

t = depth of refuse (ft)

D = in-place refuse density (lb/cy)

r = methane production rate (cf/lb/yr)

C = methane concentration (%)

Specific values used to evaluate the radius of influence for the above parameters are as follows:

t = 30 to 50 ft

D = 1000 lb/cy

r = 0.04 cf/lb/yr

C = 50 %

Qw = 22.5, 30.0, 33.75, and 37.5 cfm for wells 30 feet, 40 feet, 45 feet, and 50 feet deep, respectively. Qw was calculated by assuming an LFG extraction rate of 0.75 cfm/lf of perforated pipe length (18 feet perforated length for a well 30 feet deep, 25 feet for a well 40 feet deep, 30 feet for a well 45 feet deep, and 35 feet for a well 50 feet deep). This Qw value is judged conservative because the rule-of-thumb value for a LFG extraction rate from a well was observed by EMCON to be 1.0 cfm per ft of perforated length.

Based on the above information, the calculated radius of influence for all extraction wells, independent of depth, is approximately 206 feet. Thus, a well spacing of approximately 400 feet on-center would be adequate to capture the LFG being generated at the site.

The objective in selecting the extraction well casing diameter is to maintain the velocity of the LFG as it is extracted from the well below 200 feet per minute. Previous experience of BFI Gas Systems, Inc., has shown that the quantity of particulate matter and moisture extracted from the well with the LFG is reduced with lower extraction velocities, which reduces the potential for contaminants that must be handled by the system. Based on this criterion, it was calculated that a 6-inch-diameter well casing should be used.

Because decomposition of organic materials can result in corrosion of other materials and high temperatures and because the Landfill is subject to vertical and some lateral displacement as a result of consolidation and waste decomposition, the pipe materials used for extraction well casing must be flexible and able to withstand corrosion and temperatures in excess of 140° F. HDPE pipe was assessed to best satisfy these requirements because it is flexible, highly resistant to corrosion, and has a maximum working temperature of 160° F.

2.2.2 Gas Collection Piping

Pipe sizes were calculated using the Darcy Weisbach equation for friction loss and the following criteria:

- Maximum allowable friction loss = 1 inch of water column per 100 feet of pipe
- Pipe must be adequate to transport LFG and condensate liquid
- Extraction rates from individual wells ranged from 22.5 to 37 cfm

Results of pipe size calculations for the Landfill are included on record drawing 2. Subheader pipe sizes range from 4 to 6 inches in diameter, and main header sizes range from 6 to 12 inches in diameter.

The buried gas collection piping network was designed to meet the following criteria:

- All piping must slope toward a condensate sump at a minimum grade of 2 percent (this minimum grade allows for differential landfill settlement).
- All piping must have a minimum of 3 feet of cover.
- The side slopes of the Landfill are to be used whenever possible to establish the minimum required pipe grades (this practice reduces the number of condensate sumps required).

- All sumps must be placed on undisturbed soil to help minimize potential leakage problems that may occur from differential settling in the Landfill.

The criteria for selecting extraction well casing material also applies to the LFG collection piping. Thus, HDPE pipe was specified for this use.

2.2.3 Condensate Sumps

The four condensate sumps were constructed to prevent air from entering the LFG header system and to facilitate pumping of condensate. The condensate sump tank inlet pipe is equipped with a manual ball valve and an electric actuated true union inlet ball valve. The inlet valve precludes condensate from being drawn upward into the LFG header during pumping. When the high liquid-level sensor in the condensate sump tank is activated, the inlet valve closes, an electrically-activated vent valve in the tank opens, and the pump starts to transfer condensate from the sump tank to the condensate storage tank. The manual ball valve serves as a system backup seal. The maximum vacuum that will be applied to the LFG header during transfer of condensate was calculated to be 74 inches of water column (WC).

2.2.4 Condensate Storage Tank

The 10,000-gallon underground condensate storage tank was sized to provide storage of condensate from each of the four condensate sumps and from the knockout pot. Conservative condensate generation rate calculations indicate the condensate tank will provide in excess of two weeks of storage.

2.2.5 Gas Extraction Blowers

The extraction blowers were sized to transfer as much as 2500 cfm of LFG from the Landfill to the enclosed gas flare system at a minimum inlet vacuum of 75 inches WC and a minimum outlet pressure of 13 inches WC. The required inlet vacuum corresponds to the vacuum required to provide a minimum vacuum of 5 inches WC at the furthest extraction well and to overcome the friction loss caused by LFG movement through the LFG piping, valves, and fittings and the knockout pot. The required outlet pressure is equal to the pressure required at the flare burner ports for optimal combustion and the pressure required to overcome the friction losses in the piping and other ancillary fittings located between the blowers and the flare.

The blowers installed at the site are the centrifugal-type. The advantages of this type of blower are as follows:

- Centrifugal blowers have constant efficiency, little wearing of internal parts, ample clearance throughout the blower, and low vibration.
- Centrifugal blowers are usually direct-driven, which lowers maintenance costs.
- Because the centrifugal blowers all have outboard mounted bearings, little chance exists for lubricant to contaminate the air stream.
- Centrifugal blowers can accomodate variable air flow requirements.
- Centrifugal blowers have relatively constant pressure at constant speed.
- Centrifugal blowers produce unusually low noise; silencers are usually not required.

2.2.6 Enclosed Gas Flare System

The enclosed gas flare system is designed to flare LFG that has the following characteristics and to meet the following performance criteria:

- Flow rate
  - o Normal flow: 1500 standard cubic feet per minute (scfm)
  - o Design flow: 2500 scfm
  - o Minimum flow: 800 scfm
- Temperature: 119° F
- Pressure: 13 inches WC
- Composition
  - o 50 percent methane (CH_4)
  - o 50 percent carbon dioxide (CO_2)
- Flare system performance criteria
  - o Destruction of 99 percent of the hydrocarbons present in LFG
  - o Essentially complete destruction of vinyl chloride and other trace compounds detected in LFG

2.3 CONSTRUCTION MILESTONES

In accordance with the Administrative Order for OU 6, prefinal and final inspections of the LFG extraction system construction were conducted. Construction milestones, including the prefinal inspection, LFG extraction system startup, and the final inspection, are discussed in the following paragraphs. Construction of the removal action began on February 25, 1991, and was completed on June 13, 1991. Weekly construction progress meetings were also held and documented throughout the construction period.

2.3.1 Prefinal Inspection

On May 30, 1991, a prefinal inspection of the LFG extraction system was conducted by representatives of EPA, LI, BNR, BFI Gas Systems, Inc., HLA, and KRW Consulting, Inc. During this inspection, outstanding construction items were identified. Expected completion dates for each outstanding construction item were established. Table 2.1 presents a list of outstanding construction items identified at the prefinal inspection, actions required to complete these items, and the actual dates that the construction items were completed. To date, all items except 9 of 22 gas monitoring probes (access problems) have been completed. The prefinal inspection was documented in the Prefinal Inspection Report (HLA, 1991A).

2.3.2 System Startup

On May 31, 1991, the LFG extraction system was activated. Representatives from the enclosed flare system manufacturer and contractor were onsite to observe startup procedures, verify proper operation of the enclosed flare system, and instruct operating personnel in the proper operation and maintenance of the flare system. Representatives from KRW Consulting, Inc., the firm under contract with LI and BNR to operate and maintain the LFG extraction system, were also present to perform startup activities.

Table 2.1: Outstanding Construction Items Identified During Prefinal Inspection for Completion of Construction of the Landfill Gas Extraction System, 48th and Holly Landfill, Sand Creek Superfund Site
(Page 1 of 3)

Task	Actions Required	Completion Date
Complete 10,000-gallon condensate storage tank	Install dipstick riser Install pump Install high-level sensor Connect 3-inch outfall Install condensate line settlement protection/monitor Complete all electrical tie-ins Complete installation of gravel Construct earth berms Install bumper posts	06/15/91
Complete 3-inch condensate outfall line and connection to 8-inch sanitary sewer line	Obtain permit from City and County of Denver Wastewater Division Install 3-inch HDPE piping Obtain road crossing permit Install flow meter and vault Install sample port, valves, and manway Tie into existing sanitary sewer	06/17/91
Install bumper posts around 13 completed gas monitoring probes	Install bumper posts	06/01/91
Complete site cleanup	Remove exposed surface trash Fill and grade low lying areas	06/25/91
Complete condensate sumps	Repair or replace precast concrete sections at CS-2 Install pipe supports Install vent pipes with turbine Install exterior privacy fencing Install locks	06/28/91

Table 2.1: (Page 2 of 3)

Task	Actions Required	Completion Date
Complete blower building	Seal all pipe penetrations Install wind turbine Install exhaust fan Complete trim work and gutters Ground piping Install warning signs Install explosive gas monitoring/alarm system Label interior piping	06/24/91
Complete area surrounding blower building and flare	Install fence Install 20-mil PVC liner Install 6-inch gravel layer Install flow meter on flare side of piping Replace chart recorder in MCC Control Panel Install bumper posts around propane tank	06/19/91
Finalize extraction wells	Label lids with well number Install locks Backfill around any well heads where settlement occurred Hand-tighten sample plugs	06/15/91
Plug and abandon existing gas extraction wells	Verify proper operation of new gas extraction system Plug existing wells	06/24/91
Install remaining nine gas monitoring probes	Obtain access agreements to adjoining properties Install probes	To be determined

Table 2.1: (Page 3 of 3)

Task	Actions Required	Completion Date
Decontaminate of construction equipment	Complete site work	06/26/91
Disassemble decontamination pad	Complete site work	06/27/91
Install security fence around entire site	Complete installation	08/16/91

HDPE = high-density polyethylene
PVC = polyvinyl chloride

2.3.3 Final Inspection

A final inspection of the LFG extraction system was conducted by representatives of EPA, CDH, BFI Gas Systems, Inc., HLA, and KRW Consulting, Inc., on June 26, 1991. The final inspection consisted of a walk-through inspection of the site, including the blower building, enclosed flare system, and one of the condensate sumps. System operation was described in detail during the walk through. In addition, operation of the combustible gas sensor in the blower building was demonstrated. A summary of all completed construction activities, including dates of completion, was provided at the inspection.

On July 29, 1991, CDH issued its final inspection letter report (CDH, 1991). As of the date of CDH's report, EPA's final inspection report was not yet available.

3.0 MODIFICATIONS TO DESIGN DURING CONSTRUCTION

During construction of the LFG extraction system, modifications to the final design were necessary because of unanticipated conditions encountered in the field. In general, the modifications increased the integrity and safety of the LFG extraction system as originally designed. None of the modifications impact the operation or performance of the system as originally designed. Conditions that necessitated design modifications during construction and a description of each change are described in this section. All design changes are noted in the record drawings included as Appendix A.

3.1 SYSTEM COMPONENTS THAT WERE MODIFIED

The following system components were modified from the original design during construction of the LFG extraction system:

- Gas extraction well completion
- Blower building and flare control panel foundation details
- Blower building piping
- Blower building door lock system
- Blower building location
- Condensate storage tank
- Condensate sumps
- Security fence surrounding blower building and flare

3.1.1 Landfill Gas Extraction Well Completion

The original LFG extraction well design required installation of a polyvinyl chloride (PVC) boot fastened to the well casing via a stainless-steel clamp at the depth of the soil cover/refuse interface. Construction of the original design was not possible in 65 of the 75 extraction wells because of the depth of soil cover encountered at the extraction well locations. Record drawing 9 shows the modified well completion details. At extraction wells where soil cover thickness was 7 feet or more, the PVC boot was eliminated. Installation of a PVC boot at these depths would have required excavation of a large volume of soil to facilitate fastening of the clamp. The design was modified to include installation of a 3-foot-thick bentonite plug at the soil cover/refuse interface. Extraction wells located where the soil thickness was 3 feet or less were modified as follows: the PVC boot was fastened at the depth of the well encasement base, and a 6-inch bentonite plug was installed in the well encasement directly above the PVC boot.

3.1.2 Blower Building and Flare Control Panel Foundation Details

The blower building and flare control panel foundation details were modified to include placement of a minimum of 2 feet of compacted structural fill beneath the foundations. The structural fill allowed for excavation and placement of the footings above the refuse, and provided a stable base for the structures.

3.1.3 Blower Building Piping

All piping downstream of the knockout pot was changed from 8-inch-diameter PVC to 10-inch-diameter PVC. In addition, the location of the fail-close valve was incorrectly shown on the final design drawings. This valve was installed immediately downstream of the knockout pot as shown on record drawing 11 (Appendix A).

3.1.4 Blower Building Door Lock System

Section 16000B, Part 13 of the Technical Specifications included with the final design identifies an electric door lock for the blower building. The electric door lock system was to be explosionproof and the door was to remain locked until the building exhaust fan operated for a timed interval after which the lock would disengage and allow entry. However, an explosionproof electric door lock system could not be located. An alternative system was installed consisting of a combustible gas sensor interlocked with the building exhaust fan and an associated control panel. If the level of combustible gases in the blower building exceeds 10 percent of the LEL, the exhaust fan engages and a visual alarm is activated at the control panel. At 15 percent LEL, a visual and audible alarm is activated at the control panel and a red warning light located on the outside of the blower building above the access doors is activated.

3.1.5 Blower Building Location

The location of the blower building as shown on record drawing 1 (Appendix A) was changed to allow uninterrupted operation of an existing methane collection system during construction activities. Installation of the new blower building and flare in accordance with the final design drawings would have necessitated demolition of the existing methane collection system.

3.1.6 Condensate Storage Tank

The size of the condensate storage tank was increased from 6000 gallons to 10,000 gallons to increase the condensate storage capacity of the LFG extraction system.

Before installation of the condensate storage tank, the base and walls of the excavation were lined with filter fabric to prevent the migration of pea gravel, used as tank bedding and backfill, into the surrounding refuse.

The installation of a PVC liner in the bermed area around the perimeter of the tank excavation was eliminated. The purpose of the liner was to capture condensate if a spill occurred during transfer of condensate from the buried condensate storage tank to a tanker truck before ultimate disposal. Because the condensate will be pumped directly to an existing sanitary sewer, the PVC liner was eliminated.

3.1.7 Condensate Sump

The condensate sump design was modified as follows:

1. Chain-link fencing with privacy screening was installed around each condensate sump and associated above-grade control panel to decrease the chance of vandalism.
2. A 2-inch pump-out line was installed in the condensate sump pump suction piping to facilitate draining of the condensate sump tanks. Each pump-out line contains a 2-inch isolation valve and camlock fitting.

3.1.8 Security Fence Surrounding Blower Building and Flare

The location of the new electrical power distribution poles prevented installation of one of two 16-foot-wide gates included in the final design, located on the west portion of the chain-link fence surrounding the blower building and flare. Instead of the 16-foot-wide gate that was not included, a 4-foot-wide gate was installed to facilitate access to the control panels. Operation of the 4-foot-wide gate is not obstructed by the electrical power distribution poles.

4.0 PERFORMANCE MONITORING

The primary purpose of extracting gas from the Landfill is to mitigate LFG migration offsite. To evaluate whether the LFG extraction system is achieving this purpose, permanent gas monitoring probes are installed along the property boundary at approximately 500-foot intervals, (as shown on record drawing 1 [Appendix A]). The probes, constructed of 1-inch-diameter PVC perforated pipe, are designed to intercept potential gas migration pathways. Thus, the probes will provide early warning of migration. Probe locations on record drawing 1 are designated as GMP-XX, where XX represents a unique number corresponding to an individual monitoring point.

Section 4.1 presents a discussion of the monitoring that will be performed to assess LFG extraction system performance. Section 4.2 presents initial gas monitoring probe monitoring results obtained before and within one week after LFG extraction system startup.

4.1 MONITORING PROGRAM

Gas monitoring probes will be monitored at least monthly for methane and pressure. The system performance goal is to achieve a maximum concentration of 5 percent methane in the gas monitoring probes. The pressure in each gas monitoring probe will be measured to verify the absence of a high positive pressure gradient that may increase the migration of LFG from the Landfill.

4.2 INITIAL MONITORING RESULTS

Table 4.1 presents results from gas monitoring probe sampling immediately before and after startup of the LFG extraction system. At the time of LFG collection system startup, due to access problems, only 13 of 22 gas monitoring probes were installed.

4.3 FUTURE PERFORMANCE OF SYSTEM

Based on the data presented in Table 4.1, the LFG extraction system is adequately capturing methane at the monitored locations. Tuning of the system, including adjustment of extraction well valves and adjustment of the daily system operating time, will be conducted over the first

Table 4.1 : Initial Landfill Gas Extraction System Performance
Monitoring Results, 48th and Holly Landfill,
Sand Creek Superfund Site

Gas Monitoring Probe Designation	Percent Methane May 30, 1991	Percent Methane June 6, 1991
GMP-01	0	0
GMP-02	0	0
GMP-09	0	0
GMP-12	0	0
GMP-13	0	0
GMP-14	20	2
GMP-15	45	0
GMP-16	54	0
GMP-17	56	0
GMP-18	40	0
GMP-19	48	0
GMP-20	45	0
GMP-22	0	0

several months of operation. Long-term predictions of LFG extraction system performance can not be made until this initial adjustment period is completed.

5.0 REFERENCES

BFI Gas Systems, Inc., and Harding Lawson Associates, 1991, Final Design Submittal, 48th and Holly Landfill Operable Unit 6.

Colorado Department of Health, 1991, Letter transmitting memorandum dated July 29, 1991: Final Inspection of the 48th and Holly Landfill Methane Extraction System.

EMCON and Associates, 1982, Methane Generation and Recovery from Landfills.

Harding Lawson Associates, 1991, Prefinal Inspection Report, Gas Extraction Removal Action, 48th and Holly Landfill Operable Unit 6, Sand Creek Superfund Site, June.

U.S. Environmental Protection Agency, 1990, Administrative Order for Removal Action for Operable Unit 6, Docket No. CERCLA-VIII-90-20, August.

U.S. Environmental Protection Agency, 1990, Action Memorandum for an Enforcement-Lead Removal Action for 48th and Holly Landfill Operable Unit 6, December 24.

Appendix A

RECORD DRAWINGS

Appendix B

CERTIFICATION OF SYSTEM OPERATION

KRW CONSULTING, INC.

Kip R. White, P.E.
President

RECEIVED
AUG 16 1991
HLA

July 14, 1991

Landfill Inc.
P.O. Box 3151
Houston, Texas 77001

Subject: Landfill Gas Extraction System at the 48th and Holly Landfill Located in Denver and Commerce City, Colorado

Dear Bruce:

The purpose of this letter is to provide certification that the landfill gas collection system for the 48th and Holly Landfill has been constructed and is operating as designed. As a registered engineer in the State of Colorado, I do so certify. This certification is based on my observations conducted during various construction operations at the site and on data accumulated by KRW Consulting, Inc. during operations and maintenance of the system since it became operational in June, 1991.

This certification does not extend to an endorsement of the system design nor does it imply that the system operations or function are static. The landfill environment is very dynamic, and while the landfill gas collection system at the site has functioned as designed to date, changing site conditions may necessitate modifications to the system in the future.

If you have any questions regarding this letter, please feel free to call me.

Sincerely,

Kip R. White, P.E.

COLORADO REGISTERED
KIP R. WHITE
27475
PROFESSIONAL ENGINEER

cc. Chet Culley, Burlington Northern Railroad
Susan Wienand, Harding Lawson Associates

630 Ammons Way • Lakewood, Colorado 80215 • (303) 239-9011

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FINAL REMOVAL ACTION REPORT - GAS EXTRACTION REMOVAL ACTION
48TH AND HOLLY LANDFILL, OPERABLE UNIT 6 - SAND CREEK SUPERFUND SITE
COMMERCE CITY, COLORADO
October 31, 1991

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QUALITY CONTROL REVIEWER

Robert T. Jelinek, P.E.
Managing Associate Engineer

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